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EPA AUDITS OF STATE AND LOCAL INSPECTION/MAINTENANCE PROGRAMS: FEDERAL FISCAL YEAR 1986

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This paper was presented at the Air Pollution Control Association Specialty Meeting in Windsor, Ontario, on March 24, 1987.

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Abstract

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This paper reviews the results of EPA's I/M program audits during Federal fiscal year 1986 (FY86). EPA performed eleven initial program audits and eight follow-up audits during FY86. The paper highlights design elements that have proven successful in these programs, and discusses the applicability of those design elements to other I/M programs. The paper also summarizes the progress that has been made in resolving operating problems identified in FY86 and earlier years.

EPA AUDITS OF STATE AND LOCAL INSPECTION/MAINTENANCE PROGRAMS: FEDERAL FISCAL YEAR 1986

1.0 INTRODUCTION/BACKGROUND

As a result of the Clean Air Act Amendments of 1977, many motor vehicle inspection and maintenance (I/M) programs have been implemented across the country. I/M programs are currently operating in fifty-nine urban areas in thirty-one States and the District of Columbia (see Table 1). Approximately fifty million vehicles undergo inspections annually in these programs.

EPA's Office of Mobile Sources (OMS) decided early in 1984 that there was a definite need for a national I/M audit system and national I/M audit guidelines. EPA and State and local agencies could use such an audit program to: (1) ensure that statutory and State Implementation Plan (SIP) requirements are being met; (2) assist in developing an acceptable level of I/M program quality; (3) document the achievements, shortcomings, and needs of the various I/M programs; (4) identify programs needing further technical support or other assistance; and (5) identify technical issues common to all or many programs which need further investigation.

After consultations among officials of the State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officers (STAPPA/ALAPCO), EPA's Office of Air Quality Planning and Standards (OAQPS), and EPA's Office of Mobile Sources (OMS), it was decided that the best approach for developing the I/M audit program would be to add an I/M element to the National Air Audit System (NAAS) in federal FY1985. This necessitated the development of the national I/M audit guidelines during FY1984. In keeping with the NAAS process, a STAPPA/ALAPCO I/M subcommittee was formed to work with OMS in developing the national I/M audit guidelines. With the help of STAPPA/ALAPCO and I/M officials around the country who served as reviewers, the I/M audit guidelines were developed on schedule and appear as Chapter 6 of the National Air Audit System Guidance Manual for FY85 (EPA-450/2-84/008; December, 1984) and the National Air Audit System Guidance Manual for FY86/87 (EPA-450/2-85/008; December, 1985).

EPA started the I/M audit program in FY1984 when eight pilot audits were conducted during the spring and summer of 1984. (See Table 2 for the FY1984-85 audit schedule.) The eight pilot audits were used to test auditing concepts intended for use in the formal I/M audit guidelines as well as to get a start on the task of auditing the then twenty-five operating I/M programs. As displayed in Table 2, the FY1984 I/M audit schedule was designed to cover a cross-section of program types in order to properly test the audit concepts. The majority of

Table 1

Operating I/M Programs
as of March, 1987

Location	Start Date
Region I	
Connecticut	1/83
Massachusetts	4/83
Rhode Island	1/79
Region II	
New Jersey	2/74
New York	1/82
Region III	
District of Columbia	1/83
Delaware	1/83
Maryland	2/84
Pennsylvania	6/84
Virginia	12/81
Region IV	
Georgia	4/82
Kentucky	
Louisville	1/84
Cincinnati Suburbs	9/86
North Carolina	
Charlotte	12/82
Raleigh	11/86
Tennessee	
Memphis	8/83
Nashville	1/85
Region V	
Illinois	5/86
Indiana	6/84
Michigan	12/85
Wisconsin	4/84
Region VI	
Louisiana	9/85
Oklahoma	
Tulsa	1/86
Oklahoma City	1/87
Texas	
Houston	7/84
Dallas/Ft. Worth	1/86
El Paso	1/86
Region VII	
Missouri	1/84
Region VIII	
Colorado	1/82
Utah	
Salt Lake City	4/84
Davis County	4/84
Provo	7/86
Region IX	
Arizona	1/77
California	
South Coast	3/84
Fresno	10/84
Bakersfield	1/86
Nevada	
Las Vegas	10/83
Reno	10/83
Region X	
Alaska	
Anchorage	7/85
Fairbanks	7/85
Idaho	8/84
Oregon	
Portland	7/75
Medford	1/86
Washington	
Seattle	1/82
Spokane	7/85

the ten FY1985 I/M audits involved decentralized programs (six of eight). All of the programs, except the Texas (Harris County) program, had been in operation for at least one year at the time of the audits.

In addition to the initial audits performed in FY1985, follow-up I/M audits were conducted in several States which were audited in FY1984. The follow-up audits focused on specific aspects of the programs where problems were identified or which could not be fully evaluated during the previous audit visits.

The FY84-85 I/M program audits made apparent several key measures by which EPA would judge the success of these programs. These include:

1) High vehicle owner compliance with the inspection requirement. Any lack of participation in an I/M program directly reduces the possible emission reduction benefit of the program. In addition, as many vehicle owners who avoid inspection do so because they know their vehicles would require repair, the program emission reduction benefit is reduced further.

2) A failure rate which meets design projections. For an I/M program to function as designed, vehicles which exceed the appropriate emissions standards must be failed and repaired properly. Allowing high-emitting vehicles to escape repair also reduces the emission reduction benefit of the program.

3) A low waiver rate. Waiver provisions exist in most I/M program regulations to protect vehicle owners from excessive repair costs. However, the emission reductions of vehicles not repaired to pass program cutpoints are lower than those for vehicles which can be repaired to pass. In some cases, reviews of I/M program data indicate that no reductions are achieved on waived vehicles.

4) Adequate analyzer quality control. Inaccurate equipment can cause vehicles to be passed or failed improperly. Accurate analyzers are especially important for inspection of newer vehicles, which are subject to tighter emission standards and may be eligible for warranty coverage.

5) Effective data analysis. Effective use of high-quality inspection data is vital for I/M program management. Summaries of important program statistics (failure rate, waiver rate, etc.) are extremely useful in identifying problem stations and inspectors. In addition, overall summaries allow for evaluation of the success of the program as a whole.

Table 2

FY1984-85 I/M Audit Schedule

Location	Dates	Program Type*
Connecticut	5/14 - 5/16/84	CC
Massachusetts	5/16 - 5/18/84	DC
Colorado	5/21 - 5/23/84	DM
Arizona	5/23 - 5/25/84	CC
District of Columbia	6/04 - 6/06/84	CG
Virginia	6/06 - 6/08/84	DM
Memphis, TN	6/27 - 6/29/84	CG
New Jersey	7/10 - 7/13/84	CG/DM
Nevada	10/15 - 10/19/84	DM
New York	12/10 - 12/14/84	DC
Georgia	1/22 - 1/25/85	DM
Missouri	3/04 - 3/07/85	DM
Delaware	3/07 - 3/08/85	CG
North Carolina	3/18 - 3/22/85	DM
Texas	3/26 - 3/27/85	DT
	4/02 - 4/04/85	
Oregon	4/15 - 4/19/85	CG
Wisconsin	7/08 - 7/10/85	CC
Indiana	8/06 - 8/08/85	CC
Follow-up audits:		
District of Columbia	5/11 - 5/12/85	CG
Texas	8/26 - 8/30/85	DT
Colorado	9/24 - 9/25/85	DM

*CC = centralized, contractor
CG = centralized, government-run
DM = decentralized with manual analyzers
DC = decentralized with computerized analyzers
DT = decentralized tampering only

The FY86 I/M program audits (Table 3) differed somewhat from those in the previous two fiscal years. EPA teams generally remained on-site longer, to visit more inspection stations and evaluate the performance of additional auditors. EPA personnel also spent more time during audits examining inspection forms in stations and reviewing data with program officials. Two additional areas of concern were noted:

1) Success of overall quality assurance efforts. Fiscal problems in some States led to I/M program budget cuts. This in turn led to staff cutbacks, longer periods of time between audits, and less time (and attention) spent in stations. Previously noted quality assurance deficiencies continue to appear, including lack of useful program data and a reluctance to aggressively enforce program regulations. Many programs continue to lack a meaningful covert auditing program.

2) Performance of tampering inspections in decentralized programs. Many decentralized programs include a requirement for some type of tampering inspection, and some rely totally on tampering inspections to meet the minimum emission reduction requirement for SIP approval. However, observation of tampering inspections during EPA audits show that many are performed in a cursory manner, and inspectors often have difficulty performing a complete inspection or locating specific components when requested to do so by an auditor. In addition, roadside surveys show in some areas that tampering rates remain high even with an inspection program in place. Vehicles often go uninspected during covert audits.

2.0 SUCCESSFUL DESIGN ELEMENTS OF I/M PROGRAMS

In the course of auditing 29 I/M programs during FY84-86, EPA has identified many features of program design that have resulted in more effective and more smoothly running programs. The remainder of this paper gives a brief overview of some of these design features. Examples are given where I/M programs have reported success with these design elements, or where they have made changes to correct operating problems.

3.0 ENFORCEMENT MECHANISMS

Registration enforcement has generally proven the most effective means of maintaining high rates of owner compliance with inspection requirements. In fact, several areas have adopted registration enforcement mechanisms after experiencing problems with sticker enforcement, including Colorado and Georgia. Programs which used registration enforcement from the onset of the I/M program have reported little or no decline in registration volume due to owners seeking to avoid the inspection requirement.

Table 3

FY1986 I/M Audit Schedule

Location	Dates	Program Type
Salt Lake County, UT	10/07 - 10/09/85	DM
Davis County, UT	10/09 - 10/10/85	DM
Nashville, TN	11/05 - 11/07/85	CC
Maryland	11/19 - 11/21/85	CC
California	1/27 - 2/06/86	DC
Seattle, WA	2/24 - 2/28/86	CC
Louisville, KY	3/04 - 2/07/86	CC
Pennsylvania	3/10 - 3/13/86	DC
Idaho	3/18 - 3/21/86	DM
Fairbanks, AK	8/20 - 8/22/86	DC
Anchorage, AK	8/25 - 8/27/86	DC
Follow-up audits:		
Georgia	1/29 - 1/30/86	DM
	6/11 - 6/12/86	DM
Houston, TX	4/28 - 5/02/86	DT
Salt Lake County, UT	5/29/86	DM
Davis County, UT	5/29/86	DM
New York	6/11/86	DC
Memphis, TN	6/16 - 6/18/86	CG
Massachusetts	7/07 - 7/11/86	DC
Connecticut	9/23 - 9/25/86	CC

*CC = centralized, contractor-run
CG = centralized, government-run
DM = decentralized with manual analyzers
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Sticker enforcement mechanisms can be successful, however. For example, Texas, Louisiana, Massachusetts, and Pennsylvania all report high compliance rates. One factor contributing to the success of these programs is the fact that these areas all have statewide safety inspection programs which had been in operation for several years before emission (or tampering) inspections began. Authorizing police agencies to cite parked vehicles, and keeping collected fines in local coffers, may contribute to aggressive enforcement and low non-compliance rates in some areas.

A few areas have adopted effective "data-link" enforcement mechanisms. Data-link enforcement systems consist of matching lists of vehicles subject to inspection (most often registration data) with inspection data. Penalties for noncomplying vehicle owners which make this system effective include: suspension of vehicle registration, court summonses, and fines. Boise, Idaho, Louisville, Kentucky, and Maryland have implemented effective data-link enforcement systems.

4.0 FAILURE RATES

The reported program failure rate is one of the most important indicators of the success of program operation. Centralized programs, and decentralized programs with computerized analyzers, have traditionally reported failure rates close to what would be expected for a given set of cutpoints. This has not been the case in decentralized, manual analyzer programs, where the manual nature of the equipment does not allow for control over the inspection procedure (See Table 4).

The State of Colorado, for example, has experienced serious problems with inspector performance, leading to a very low failure rate. An overall failure rate of 7.9% was reported for 1986, although voluntary emissions inspections at the Denver area Emissions Technical Centers consistently resulted in failure rates over 30%. The Colorado Department of Health has estimated that manual design elements, improper inspections and waivers had led to a 30% loss of program benefit. In an effort to eliminate improper inspection procedures, the State adopted a requirement for computerized analyzers, to take effect in July 1987. In response to the 1984 EPA audit, and due to problems with aging equipment, New Jersey also switched to a requirement for computerized analyzers in the decentralized inspection stations. New York is currently in the process of making this changeover.

5.0 WAIVER PROVISIONS

Waiver systems are managed with varying degrees of success. The best systems are characterized by stringent requirements for obtaining a waiver, and strict State oversight. One example of a well-designed waiver system is the system in effect in El Paso, Texas. To receive a waiver,

Table 4

REPORTED EMISSION TEST FAILURE RATES IN I/M PROGRAMS*

CENTRALIZED (CC)

Arizona	20.2 %
Connecticut	17.2
Delaware	13.7
Kentucky	15.7
Maryland	14.6
Memphis, TN	8.1
Nashville, TN	24.5
New Jersey	26.1
Oregon	24.0
Washington, D.C.	18.4
Washington	19.0
Wisconsin	15.3

DECENTRALIZED

Computerized Analyzers (DC)

Alaska	
Anchorage	15.7 %
Fairbanks	19.4
California	27.7
Michigan	15.8
New York**	5.1
Pennsylvania	17.6

Manual Analyzers (DM)

Georgia	6.6 %
Idaho	9.8
Missouri	6.7
North Carolina	5.6
Nevada	
Clark County	9.5
Washoe County	11.0
Utah	
Davis County	8.7
Salt Lake County	10.0
Virginia	2.3

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* For all model years, including light duty trucks.

** New York's analyzers are only partially computerized.

vehicles must go through a low-emission tune-up sequence, receive all warranty repairs, and any necessary repairs not covered by warranty up to a $200 cost limit. In subsequent years, the cost limit rises to $400. Waivers are only issued by the Department of Public Safety, which oversees the inspection program.

There are ways of maintaining administrative control over a waiver system without direct State issuance of waivers. One option is to monitor waivers through data analysis. Mechanics who issue a higher than average number of waivers can be targeted for auditor attention and perhaps additional training. The Salt Lake County, Utah data handling system produces a monthly "improper waiver" report, which lists vehicles that were issued a waiver without meeting the appropriate requirements by station and mechanic. Another method of limiting the number of waivers administratively is to increase the amount of paperwork required of vehicle owners and mechanics to better ensure adherence to waiver provisions; for example, use of detailed application forms, and requiring complete repair documentation. Pennsylvania reports success with the use of such forms, and Salt Lake County, Utah has adopted a similar system.

The effectiveness of repairs sought in the course of obtaining a waiver may be supported by a requirement for a minimum emission reduction. A reduction requirement of 10-20% provides a tangible improvement in idle emissions of waived vehicles, and ensures that vehicles in which emissions become worse by improper repairs are not given waivers.

Repair effectiveness may also be improved by providing emission-related training to mechanics in the program area. This can be scheduled as part of an inspector recertification course, or offered on a voluntary basis through a local community college or vocational center. In some programs, repair facilities employing mechanics who have received this training can be advertised as "certified" repair facilities. Alternatively, stations identified through data analysis as reporting the lowest retest emission levels or the lowest waiver rates can be publicized as having the best repair records. The Louisville, Kentucky program collects data on repairs performed, waiver rates, and repair cost, and regularly publishes a repair facility report.

Many States have had problems with high waiver rates, usually due to lenient requirements. High waiver rates usually appear in areas requiring an engine parameter adjustment procedure, or setting a low cost limit (for example, $25 for pre-1981 vehicles and $50 for 1981 and newer vehicles) for required repairs. Several programs have tightened their waiver requirements recently, including Arizona, Colorado, and Louisville, Kentucky.

6.0 DATA ANALYSIS

The FY84-85 audits revealed serious data processing shortfalls in most programs. The programs audited in FY86 were generally found to have more successfully implemented data analysis systems.

Data collection is easiest in centralized programs with on-line emission analyzers. In decentralized programs, computerized analyzers greatly simplify data handling for inspectors and program managers by storing keyboard-entered inspection data on cassettes for later transfer onto computer tape. A few decentralized programs also have had some success with inspection forms designed to be read by an optical scanner. Data loss due to soiled or improperly filled-out forms can be high in this type of system; however, some smaller I/M programs return unreadable forms or forms with errors to inspection stations for copying or correction. The Utah County, Utah I/M program takes this approach and reports an unusable form rate of less than 1%.

Many I/M programs have excellent capabilities for analyzing the data they collect. Reports of failure rates by model year are useful in determining whether the stringency of the cutpoints is fairly consistent throughout the range of years tested, or if the cutpoints for any given model year (or model year group) are too tight or too lenient. In addition, reports of failure rate by emission level (i.e., what percentage of vehicles would fail at a given cutpoint) have been extremely useful to EPA and State and Local agencies. Reports of failure rate by pollutant have also proven useful to program managers in determining whether cutpoints have been selected properly (officials in areas experiencing CO violations only, for example, often do not wish to fail a large percentage of vehicles for HC alone).

Reports of waiver rates and calculation of average idle emission reductions on waived vehicles are useful in evaluating the effectiveness of the repair requirements for any given model year or model year group. Analysis of waiver rate by pollutant is helpful in determining the appropriateness of specific repair sequences (the so-called "five-parameter adjustments"); Colorado, among other States, has found that engine adjustments alone are somewhat effective in reducing CO emissions but have less impact on HC emissions. Colorado has recently supplemented the adjustment requirements with a minimum repair expenditure, and increased the repair expenditure requirement for 1981 and newer vehicles as well.

Most useful to I/M program managers, especially in decentralized programs, are reports of program statistics by station and by inspector. Reports of failure rates by station and inspector, in conjunction with information on the average model year mix of vehicles inspected by each station, can be

used to pinpoint inspectors who are reporting a lower than average failure rate, and who may be performing inspections improperly. This information is useful in both tampering and emissions programs. Reports of waiver rate by inspector/mechanic may be used to identify mechanics who are waiving vehicles at a higher than average rate, indicating that they may be waiving vehicles improperly or may need additional repair training. Individual vehicles which have been passed or waived improperly can be brought to the attention of the responsible inspectors; Utah County, Utah I/M officials require inspectors to recall these vehicles to the station and process them properly, or face suspension. Reports of repair cost by station can be useful in identifying stations which may be unfairly overcharging for repairs or performing unneeded work, as well as stations which are improperly passing vehicles rather than performing necessary repairs. These types of summaries of station performance can be useful to auditors during station visits to point out possible problem areas, and to enable station personnel to compare their performance to the performance of the I/M program as a whole.

7.0 INSPECTION STATION AUDITING PROCEDURES

An important part of each EPA audit is an evaluation of a program's station audit and surveillance efforts. A strong quality assurance program is essential to ensure that the program is operating as intended and that program objectives are being met.

EPA audits have shown that most station auditors do their jobs well. Most are conscientious, well-organized, and have a good rapport with the station personnel with whom they work. Most programs appear adequately staffed, although some States have experienced cutbacks recently due to budget problems. Nearly all programs have established standardized audit procedures, and some programs periodically rotate auditors to different sections of the I/M area. These measures help ensure that all of the stations in the I/M program are treated consistently.

Consistent follow-up on problems identified during stations visits is vital. Several I/M programs have adopted penalty schedules, standardizing the penalties for various offenses. A quick process for closing stations or suspending inspectors in violation of program regulations permits program officials to retain control over station and inspector performance.

Covert auditing is an extremely useful tool in decentralized programs for learning how well inspection stations are performing and for providing a basis for action against bad operators. Although most programs do some undercover work, few have organized programs capable of

visiting each station at least once per year. The best systems are those in which used cars are obtained periodically and sent to stations in a maladjusted or tampered condition. Part-time or temporary personnel often operate the vehicles, and funds are provided to cover the cost of inspection fees. Colorado uses a fleet of several vehicles, and performed over 1800 covert audits at 1350 stations in 1986, resulting in nearly 300 enforcement actions.

8.0 CONCLUSION

At this time, almost all operating I/M programs have been audited by EPA. EPA is encouraged by the results of the FY86 audits and by the generally successful implementation of I/M programs, although some areas continue to have serious operating problems. Substantial progress has been made in some of these areas toward correcting operating deficiencies. The solutions to most problems are well known and have been successfully implemented by many I/M programs, as outlined above. EPA is confident that the quality of I/M programs nationwide will improve as more areas identify problems and adopt design enhancements to address them.

EPA's program of auditing I/M programs is an ongoing process. The first cycle of audits was basically completed in FY86, and future audits will be directed toward evaluating the few remaining new programs and following up on States' efforts to correct problems already identified. EPA also plans to work with STAPPA/ALAPCO during FY87 to develop revised I/M audit guidelines for FY88 and FY89.

I/M programs are a major part of most areas' strategies for reaching attainment and assuring maintenance of the ambient ozone and carbon monoxide standards. I/M will play an even greater role as some areas look at additional strategies to deal with intractable ozone and CO problems. The audit process will continue to play an important role in achieving the greatest possible environmental benefit from I/M.